

APPLICATION

of

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for

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on

WHEELCHAIR WITH BOOK-STYLE FOLDING FEATURE

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WHEELCHAIR WITH BOOK-STYLE FOLDING FEATURE

BACKGROUND OF THE INVENTION

Field of the Invention:

This invention relates to certain significant improvements in wheelchairs and particularly to improvements in the transportation, storability, and comfort of reclining and non-reclining wheelchairs, such as those shown and described in my U.S. Patent Nos. 5445,443 and 6,533,358. This invention also provides a kit which permits a foldable non-adjustable straight-backed wheelchair to be converted into a rigid foldable, adjustable-backed wheelchair, wherein the back of the wheelchair can be positioned along a continuum between a fully reclined position and an upright position and wherein the back portion of the kit is configured with the back support of this invention, which could also be used to provide the support needed to accommodate patients suffering from spinal abnormalities or kyphosis (hunchback).

15 Description of the Prior Art:

Prior art wheelchairs have either a non-supporting, flexible, foldable soft back, which does not provide the necessary back support for patients who need it when using them regularly, or have a rigid back which provides the necessary support but does not fold, making transport and storage very awkward.

20 In particular, prior art folding wheelchairs have been provided with flexible, sheet-like, non-supportive seat backs. These seat backs were often nothing more than an expanse of flexible material attached to the side frames of the wheelchair. These seat backs have proven to be undesirable for many reasons. Primarily, these seat backs do not provide the back support needed by most patients which leads to discomfort and possibly aggravation of existing back problems. This problem is acute for patients seated in foldable wheelchairs with flexible backs and seats, which tend to hammock. Moreover, presently available reclining back wheelchairs are not configured to accommodate spinal deformities such as

kyphosis. Furthermore, these prior art seat backs could not be modified to provide for the individual needs of many patients. Finally, many prior art seat backs provided only a single upright position for patients.

Certain kits are available to convert these conventional folding non-reclining wheelchairs into reclining back wheelchairs and TLSO devices. One such kit is sold by Medisol U.S.A. of 9713 Factorial Way, South El Monte, CA 91733 under the trademark REHABACHAIR. The kit produced by Medisol is described in U.S. Pat. Nos. 5,445,433 and 6,533,358 which patents are hereby incorporated by reference in their entirety. These prior art kits, however, while very useful in their ability to convert wheelchairs from non-reclining mode to reclining mode, do not provide comfortable support for patients with severe spinal deformities in combination with foldability for ready transport or storage.

Various non-folding reclining back wheelchairs are available. One such chair is the BCW recliner chair, offered by Wheelchair Institute of Kansas, of 910 Main Street, LaCrosse, Kansas 67548. However, the available non-folding reclining wheelchairs are heavy, bulky and very costly when compared to non-reclining wheelchairs.

Prior art wheelchairs are also available which generally comprise a one-piece back support cushion of fixed density or rigidity which does not provide the particular support or comfort needs for persons with back problems.

There accordingly remains a need to provide a reclining wheelchair having improved comfort and back support, especially for patients with spinal abnormalities; while at the same time providing a readily foldable wheelchair for ease of transport and storage. There also remains a need for a retrofit kit which can be used to convert conventional wheelchairs, e.g., folding non-reclining straight back wheelchairs, into a folding reclining wheelchair that provides improved comfort and support, especially for patients with kyphosis and/or other abnormalities, combined with foldability for ease of transport and storage.

SUMMARY OF THE INVENTION

The invention disclosed herein solves certain significant problems associated with prior art wheelchairs. This invention provides a wheelchair which combines the attributes of a supportive, comfortable seat back with the transportability and storage benefits of a foldable wheelchair. The combination of rigid support and comfort provided by this invention is ideally suited for patients who suffer from a curvature of the spine, particularly kyphosis. The added benefit of foldability increases the mobility of patients by providing easy transport and storage of the wheelchair. Moreover, the design of this invention allows for the wheelchair to be customized to accommodate the spinal deformities of any particular patient. In this manner, this invention not only provides comfort and quality of life to patients but also may provide therapeutic treatment by providing the needed support.

This invention comprises a wheelchair with a book-style folding feature in the seat back. The seat back is capable of providing needed support while in the non-folded condition by means of the placement at least two rigid but cushioned, panels provided on either side of a generally centrally located, relatively flexible, longitudinally extending, cushioned area – analogous to the hinged back or spine of a book. To enable the wheelchair to be "folded", i.e. compressed so that the wheels are closely adjacent each other, the rigid panels of the seat back are folded about the flexible spine, in a manner similar to the hinging of the covers of a book about its spine, simultaneously with the folding of the seat portion of the wheelchair.

This invention comprises, also, a retrofit kit e.g. for converting a folding, non-reclining wheelchair having two side frames, a seat portion and a standard seat back, into a folding, reclining wheelchair having an improved seat back which comfortably supports the patients in variably reclined positions. The kit includes an adjustable strap which is connected to the side frames of the wheelchair. This strap may include buckles or other quick release fasteners for releasing the strap. The kit also includes an improved folding seat back of this invention to replace the standard seat back found on most wheelchairs. This

improved seat back is configured to provide the needed support for all patients including those with spinal deformities. The seat back may be hingeably or flexibly connected to each side frame. Ideally, the adjustable strap and rear of the seat back are provided with corresponding hook and loop fastening strips such as Velcro. By adjusting the lengths of the straps or simply repositioning the straps along the Velcro strips, the seat back may be raised to an upright position or lowered to a reclining position. This is facilitated by the hinges or flexible fasteners which connect the seat back to the side frames.

Significant additional comfort of this invention's seat back is provided in several ways. Kyphosis patients, in particular, may have large curvatures in different locations along the spine. This invention allows customized cut outs to be made in the right and/or left support panels of the seat back – which correspond to individual patient's spinal abnormality. These comfort features of my improved seat back relieve the irritation, chafing and, in extreme cases, sores caused by conventionally backed wheelchairs. These problems with conventionally backed wheelchairs are known to aggravate spinal conditions when they occur in patients.

The back support of this invention provides good support both in an upright and reclining position. Substantial back support is required by all wheelchair patients, particularly in a reclined position, and the back support of this invention keeps the spine in a more natural position while reclined. In a patient with abnormal spinal curvature such support also may prevent aggravating the condition.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 shows a prior art wheelchair, namely a conventional foldable wheelchair with flexible back support;

FIGURE 2 is a modification of Figure 1 showing a replacement of the flexible back support with my invention;

FIGURE 3 is a plan view of back support of the invention;

FIGURE 4 is a cross-sectional view of the back support of FIGURE 3.

FIGURE 5 is an exploded view of back support of the invention;

FIGURE 6 shows the wheelchair in folded condition; and

FIGURE 7 shows the wheelchair of the '358 patent with the seatback modification of
5 this invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS AND CLAIMS

Conventional foldable wheelchairs have either a non-supporting sling back, soft
10 back, which does not provide the necessary back support for patients who need it, or have a rigid back which provides the necessary support but does not fold, making transport and storage very awkward. A prior art retrofit kit modifying the conventional wheelchair with a more supportive, reclining seat back is available. However, this prior art kit does not provide foldability.

15 Figure 1 depicts a typical sling back folding wheelchair. The wheelchair 20 is composed of two side frames 22, a sling back 24, and a sling seat 26 as well as the wheels and arm rests and other common features of wheelchairs. A variety of mechanisms attached to the side frames are known in the prior art to alternatively hold the side frames apart or to bring the side frames together. Such wheelchairs are able to fold because the sling back and
20 sling seat are typically made of flexible material which offers no resistance to bringing the two side frames into close proximity.

Such wheelchairs come in a variety of heights and widths as well as having various configurations of side frames 22. The present invention is designed to be used on the various folding wheelchairs 20 known in the art. The present invention can readily be customized to
25 fit most such wheelchairs by replacing the sling seat 26 which does not provide the back support needed by many patients.

As depicted in Fig. 2, the present invention provides a seat back 28 which provides the needed support and can be folded along with the wheelchair 20a. This invention can also

be provided with features for reclining. Furthermore, this invention provides increased comfort for all patients and may be provided along with a kit for replacing the conventional seat back on a conventional folding wheelchair.

5 The seat back 28 of the present invention is typically mounted to the side frames 22 of the wheelchair 20a. At least one flexible fastener 30 mounts the seat back to each side frame. The seat back 28 of the present invention may replace the sling back 26 of the prior art wheelchair or the wheelchair may be originally provided with such a seat back.

10 The flexible fasteners 30 may comprise a variety of configurations. The function of the flexible fasteners is to pin the seat back 28 to the side frames 22 at the location of fastening while allowing relative motion between the side frame and seat back. Primarily for purposes of folding, the flexible fasteners need to allow the seat back to bend backward or forward. However, the flexible fasteners must also firmly hold the seat back to the side frame while a patient is resting against the seat back. One type of fastener shown to be effective for this purpose is a loop of material sewn to the seat back which is bolted to the side frame as shown in U.S. Patent No. 6,533,358. A hinge type fastener may also provide the properties needed for folding and support.

15 As depicted in Figure 3, the seat back 28 of the present invention is preferably large enough to cover all, or a major portion of the patient's back. The bottom of the seat back may extend down to the sling seat 26 to support the patient's lower back. The top of the seat back may extend up to the patient's shoulders so that the seat back supports the patients upper back. Alternatively, the top of the seat back may extend well above the patient's head so that the patient's head and neck are also supported.

20 As depicted in cross-section in Figure 4 and in an exploded view in Fig. 5, the seat back 28 of the present invention comprises at least two spaced apart rigid panels 32 (one on the right side of the seat back and one on the left side) covered by a foam padding 34. The positioning of the spaced apart rigid panels 32 defines a longitudinally extending central area or region, which is flexible and foldable, and which area or region is designated herein as the "spine" 38 or as the "flexible spine" 38. The spine 38 is generally aligned with the central longitudinal axis 40 of the seat back 28. The foam padding may completely cover the rigid

panels 32 on all sides and spine 38. The foam material may also be surrounded by a sturdy covering 36. This covering may also be padded, possibly stain resistant and even decorative depending on need or desire.

5 The rigid panels 32 may be formed of a variety of materials. Plywood panels have proven to have the necessary rigidity for this purpose. Sheets of plastic or light weight metal may also be appropriate. The rigid panels may be flat or form a curved surface to conform to a patient's back. One possible configuration of the rigid panels is depicted in Fig. 5.

10 As the wheelchair 20 is folded by bringing each side frame 22 into close proximity, the seat back 28 of the present invention will fold like a book about axis 40. This configuration is shown in top view in Fig. 6. Thus, the left and right rigid panels 32 fold into close proximity about the flexible spine 38 forming two halves of the seat back 28. The flexible fasteners 30 connecting the seat back to the side frames permit the halves of the seat back to rotate approximately 90 degrees relative to each side frame 22.

15 Ideally the foam padding comprises a front panel 42 and a rear panel 44. Each of these foam panels may completely cover one side of rigid panels 32. The foam panels and the rigid panels may all be fastened together by a variety of fastening means. Preferably the foam panels 42, 44 and the rigid panels 32 are all internally secured by a suitable glue to form the unitary seat back 28. Alternatively a series of pins, bolts or similar fasteners may be used to connect the foam panels and the rigid panels into a flexible seat back.

20 The material used to make the foam padding 34 is preferably a sturdy, durable foam with suitable memory properties. Foams with suitable memory properties are those that do not immediately snap back to their original condition after being compressed. Thus, the foam panels 42, 44 may retain their compressed condition in those areas which are compressed by the patient's back. This adds significantly to the patient's comfort. A suitable
25 rubber foam known to have the appropriate combination of properties is manufactured by Vanguard Foam and Packing in Gardena, California as HR-28250.

The front panel 42 and rear panel 44 of the foam padding 34 ideally cover the entire front and rear surfaces of the seat back 28, including the flexible spine 38 formed along the

longitudinal axis 40 of the seat back between the rigid panels 32. By flexing the foam padding along the flexible spine 38, the seat back may folded. Ideally the foam material is also sturdy enough to withstand repeated folding and unfolding of the seat back.

Furthermore, having a flexible spine 38 along the longitudinal axis 40 of the seat back 28 greatly increases the comfort provided by the seat back. The flexing of the foam material in the spine of the seat back provides a certain amount of give in response to pressure applied by the patient. This prevents the otherwise supportive and rigid seat back from having a hardened, solid feel particularly in the area of the seam. Thus, although the seat back provides rigid support on both the left and right side of the patient's back where support is most needed, the spine 38 is flexible along the patient's spinal area where comfort is most needed.

Moreover, the rigid panels 32 may be sculpted to provide the variable support needed by some patients. Certain deformities of the spine create an irregular curvature such as produced by kyphosis. Kyphosis (known as hunch back) forms outward extending humps in a patient's back. To accommodate these and other deformities, the rigid panels may have cutouts 46 in the affected area. The cutouts are areas in which material has been removed from the rigid panels to create a hole covered by the foam padding 34. Ideally the area formed by these cutouts corresponds with the patient's spinal deformity. In this manner the affected area of the spine may be compressed against the foam padding of the seat back 28 rather than the rigid panels. Possibly, the seat back may be customized for individual patient's support and comfort needs, by sculpting cut outs in the rigid panels as needed.

Preferably the seat back 28 includes a protective covering 36 which surrounds the exterior of the seat back. The covering may be formed of a durable fabric to protect the interior of the seat back and adds to the overall strength and durability of the seat back. This covering also may include a zipper 48 so that the covering may be removed. The covering may also be waterproof to prevent water damage. Since the covering comprises the visible exterior of the seat back it may also provide a decorative quality to present a pleasing look to the seat back and the wheelchair 20.

A prior art kit modifying the conventional wheelchair 20 into a reclining wheelchair replaces the non-reclining flexible seat back with a rigid reclining seat back 29. The prior art kit also provides for adjustable straps 50 which connect the reclining seat back to the conventional side frames 22. These adjustable straps include loops 52 which wrap around the side frames and snaps, buckles or adjustment rings to modify the length of the straps. The loops wrap around the conventional side rails and back around the rear surface of the seat back. By lengthening or shortening the straps using the buckles 54 the seat back may be adjusted to a variety of reclining configurations. The adjustable strap and rear of the seat back may also be provided with corresponding hook and loop type fastening strips 56 such as Velcro.

The reclining seat back 29 of the prior art kit is provided in a variety of configurations. The reclining seat back may be curved and/or padded to provide for the individual back support needs of the patient. This reclining seat back may be configured as a thoracic-lumber-sacral correcting orthosis ("TLSO") device. With the TLSO and reclining features of this seat back, the prior art kit has modified a conventional wheelchair into a device providing both rehabilitative care and mobility to a patient.

The prior art kit has also provided several other wheelchair modifications for rehabilitative care. An accessory padded seat cushion may be provided as relatively stiff or soft according to patient needs. Covers may also be provided to cushion the arm rests. For patients that require additional support, torso restraining straps may be attached to the seat back and configured to wrap about the torso or abdomen of the patient to avoid slipping.

As depicted in Fig. 7, the seat back 28 of the present invention may be secured as a reclining seat back 28a, in the manner described in my U.S. Patent No. 6,533,358. In this configuration, the reclining seat back 28a may further comprise the adjustable straps 50, with loops 52 for attaching to the side frames 22 and buckles 54 for adjusting the length of the strap as well as fastening strips 56. In this configuration, the present invention not only provides comfort and support, but these features are combined with the therapeutic benefits of reclining and the mobility and convenience benefits of folding.

The drawings and foregoing description are not intended to represent the only form of the invention in regard to the details of its construction and manner of operation. It will be evident to those skilled in the art that modifications and variations may be made without departing from the spirit and scope of the invention. Changes in form and at the proportion of parts as well as the
5 substitution of equivalents are contemplated and although specific terms have been employed, they are intended in a descriptive sense only and not for the purpose of limitation, the scope of the invention being delineated in the following claims: